Contribution ID: **1087** Type: **Oral**

Particle identification in proton boron fusion reaction using Timepix3 detector

Monday 24 October 2022 14:45 (15 minutes)

Proton-Boron Capture Therapy (PBCT) is a novel approach of radiation therapy aimed at enhancing proton biological effectiveness to cancer cell killing. PBCT uses a nuclear fusion reaction between low-energy protons and 11B atoms, which produces highly DNA-damaging α-particles. As a result of the interaction of low energy proton with 11B nucleus, three alpha particles are generated, which eventually stop inside the tumor and release all their energy in cancer cells:
p + 11B ⟶ 3 α + 8.68 MeV
Experimental measurements have been performed at the Nuclear Physics Institute of the CAS, CANAM laboratory in Řež using 3 MV Tandetron accelerator. Low energy proton beams (2.5, 1.5 and 1.25 MeV) were incident on 11B and natural boron isotope mixture targets. Generated particles were detected using pixel Timepix3 detector with 300 μm silicon layer. This device enregistered not only alpha particle emission from the nuclear reactions of protons with boron, but also backscattered protons. Python scripts and data processing engine (DPE engine) have been applied to analyze the obtained data. The proton incidence angle was 0^0 and the Si Timepix3 detector was placed at 170^0 laboratory angle. The applied experimental setup and obtained results will be described and discussed.

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Session Classification: Applied Research

Track Classification: Applied Research